SECTOR ASSESSMENT (SUMMARY): ENERGY (RENEWABLE ENERGY) FINANCING

A. Indian Energy Sector

1. Power supply constraints have been cited as a factor constraining the growth of the Indian economy, and expansion of the power sector is seen as a prerequisite to achieving economic targets. The Twelfth Five-Year Plan (2012–2017) reports a peak power shortage of 11.1% and an overall energy shortage of 8.5%, and demand for power is expected to increase by 5.7% annually through 2017.[1] India's integrated energy policy envisions 425 gigawatts (GW) of installed generating capacity by fiscal year (FY) 2021 to support the economic growth target of 8.0%, an increase from the existing total installed electric generating capacity (as of 31 December 2013) of 234 GW. To power growth while prioritizing energy security, the Government of India has ambitious programs that target renewable energy development. These initiatives are consistent with India's pledge to keep per capita greenhouse gas emissions below those of developed economies.

B. Energy Policy and Regulatory Framework

2. The Electricity Act, 2003 is the cornerstone legislation for the power sector in India, and provides the legal framework for its efficient development. The act primarily addresses sector development through the unbundling of state electricity boards, open access, and competition; important provisions of the Electricity Act, 2003 include (i) exemption from licensing requirements for electricity generation, (ii) open access in electricity transmission, (iii) licensing for electricity trading, (iv) arrangement of licenses for laying private transmission lines, (v) promotion of competition by allowing multiple distribution companies to operate in a single supply area, (vi) ensuring the supply and minimum standard of electricity supplies, and (vii) provision for the establishment of tribunals in place of the High Court for appeal against the orders of the Central Electricity Regulatory Commission.

3. The central government's Ministry of Power provides overall policy guidance to India's power sector. The Ministry of New and Renewable Energy (MNRE) provides overall policy guidance for the renewable energy subsector. The Rural Electrification Corporation and the Power Finance Corporation are government-owned institutions dedicated to financing power sector activities. The Indian Renewable Energy Development Agency (IREDA) is a government-owned institution dedicated to financing renewable energy; it also administers some MNRE subsidy schemes for renewable technologies. Power trading has been developing over more than a decade in India, and is facilitating the optimal use of power resources within India. In all technical and economic matters, the Ministry of Power and MNRE are assisted by the Central Electricity Authority, which is responsible for the technical coordination and supervision of programs, and is also entrusted with a number of statutory functions. The Central Electricity Authority is also responsible for preparing a national electricity plan, in accordance with the National Electricity Policy, and for modifying the plan every 5 years.

C. Renewable Energy Overview

4. As of 31 December 2013, approximately 12.8% of India's generating capacity of 234 GW (or 30 GW) was classified as renewable. India's renewable energy mix comprises 67% wind power (20 GW), 13% small hydropower (4 GW), 13% biomass, co-generation, and waste-

[1] Peak power shortage refers to the shortage at time of peak demand; the overall energy shortage refers to the energy demand over the year that went unmet.

to-energy (4 GW), and 7% solar (2 GW). At the end of 2012, India was ranked fifth globally in terms of installed wind capacity, and sixth for installed non-hydro renewable capacity.[2] India has a vast untapped renewable energy potential that could be harnessed to supply substantial electricity from indigenous sources. The National Action Plan on Climate Change (NAPCC) sets a target of generating 15% of India's power from renewable sources by 2022, and one of the eight missions under the NAPCC focuses on increasing grid-connected solar power capacity from 2 GW to 20 GW by 2022. The Twelfth Five-Year Plan targets 30 GW of renewable capacity additions during FY2012–2017, and an additional 45 GW during FY2017–2022. The Planning Commission published a report on Low Carbon Inclusive Growth in 2011,[3] and released the India Energy Security Scenarios, 2047 in 2014;[4] both envision that renewable energy and energy efficiency will make major contributions to India's energy sector strategic objectives for the foreseeable future.

5. Incentives are offered by the central government and Indian states to increase the financial viability of renewable energy projects.[5] The current policy focus is on preferential tariffs established through competitive bidding,[6] although, for example, generation-based incentives are available for some technologies.[7] Renewable energy generation costs are trending toward grid parity, and India expects preferential tariffs will become less important, with the renewable energy certificate market becoming the main mechanism through which renewable attributes are valued. This mechanism has not played a prominent role to date, however; trading volumes and prices are low, and the enforceability of renewable purchase obligations and the pricing floors of renewable energy certificates uncertain.

6. India's relevant regulatory conditions and physical infrastructure are evolving to accommodate the increasing share of renewable energy in the power generation mix. Central support is strengthening the national and state transmission systems, with the aim of ensuring that areas with the most renewable resources (and often the lowest marginal generation cost) can be developed, and the associated power evacuated to serve loads near and far. MNRE and the Forum of Regulators commissioned the Power Grid Corporation of India to conduct a study on Green Energy Corridors to identify the transmission infrastructure required to support the renewable capacity additions planned during 2012–2017.[8] The central government is also supporting development of renewable energy management centers that would use state-of-the-art grid management approaches to effectively integrate variable renewable (wind and solar photovoltaics) into the existing power system. These actions signal the government's commitment to a future power system that incorporates strong contributions from renewable energy sources.

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[2] REN21. 2013. *Renewables 2013 Global Status Report*. http://www.ren21.net/Portals/0/documents/Resources/GSR/2013/GSR2013_lowres.pdf

[3] Government of India. 2011. *Interim Report of the Expert Group on Low Carbon Strategies for Inclusive Growth*. Available: http://planningcommission.nic.in/reports/genrep/Inter_Exp.pdf

[4] Government of India. *The India Energy Security Scenarios, 2047.* http://indiaenergy.gov.in/

[5] MNRE. *Renewable Energy Regulatory Framework*. http://www.mnre.gov.in/information/renewable-energy-regulatory-framework/

[6] A competitive bidding process is one where bidders submit their project for consideration along with a proposed tariff for the electricity generated; projects meeting technical and financial prerequisites are awarded contracts starting with the lowest bidders until the capacity has been reached.

[7] Generation-based incentives (also known as feed-in tariffs) pay a fixed tariff to generators for each kWh of electricity produced; capacity-based incentives provide funds scaled to the amount of installed capacity, not the amount of energy actually being produced.

[8] The Forum of Regulators is comprised of the Central Electricity Regulatory Commission chairperson and the chairpersons of the State Electricity Regulatory Commissions. It is tasked with harmonizing power regulation, setting standards, sharing ideas, and advancing knowledge and practice in electricity regulation.

7. In India, renewable energy project development has been driven by independent power producers (IPPs), which still face several challenges. Many parts of India still have substantial transmission and distribution system losses and unrationalized tariff schemes, which contribute to the poor financial health of many state utilities (distribution companies), resulting in payment delays to IPPs, and questions about the bankability of power purchase agreements signed by these financially challenged entities. IPPs who enter into power purchase agreements with entities other than local distribution companies incur open access charges;[9] these vary among states and have been retroactively revised in some cases. The government has introduced a distribution company restructuring scheme, to which several have subscribed. If successful, this scheme will improve the outlook for IPPs.

8. The government also supports improved energy efficiency, and established the Bureau of Energy Efficiency as a statutory body under the Ministry of Power in response to the 2001 Energy Conservation Act. More recently, the government launched the National Mission on Enhanced Energy Efficiency as part of the NAPCC. Government initiatives target many types of efficiency improvements (e.g., appliances, buildings, and industry). The government has instituted a cap-and-trade system ("Perform–Achieve–Trade") for large industrial and commercial consumers, with a first mandatory participation cycle implemented for eight industrial sectors during 2011–2014. The scheme allows efficiency gains in excess of the targets to be traded to consumers that have not achieved their targets as required. Demand-side management is also supported by MNRE through support for solar agricultural pumps and biomass cogeneration.

D. Asian Development Bank Power Sector Experience and Assistance Program

9. The strategy of the Asian Development Bank (ADB) for investing in India's power sector targets loss reduction, strengthened infrastructure, clean energy promotion, and efficient energy use. India's distribution network has high technical and commercial losses, and ADB has invested in reducing those losses, improving supply quality, and extending the distribution network. ADB has invested in strengthening India's transmission network and plans to support required investments identified in the Green Energy Corridors study. ADB is supporting transmission expansion in Gujarat and Rajasthan states to bring solar and wind power from remote generation sites to the main grid and deploy smart-grid technologies to support efficient grid management. ADB has supported hydropower project development and has a planned investment for two concentrating solar power projects. However, the private sector is leading clean energy project development in India, and the investment in IREDA addresses financing constraints that are slowing the expansion of renewable energy generation. India has targets to steadily increase the share of renewables in its power generation mix, and ADB's investments are supporting increased renewable energy generation capacity as well as a strengthened grid infrastructure for efficient management and delivery of power throughout the network.

E. Renewable Energy Finance

10. Private sector developers are leading the expansion of the renewable energy sector in India, enabled by the energy sector market reforms. Approximately $39 billion is required to achieve the clean energy goals described in the Twelfth Five-Year Plan; this will increase under the estimated Thirteenth Five-Year Plan period from 2017−2022. However, a high interest rate environment and the lack of long-term funds have restricted renewable energy sector development. Because of the relatively high upfront (per megawatt) cost of renewable energy

[9] These charges are incurred for use of the transmission and distribution networks.

projects, loan tenors of 12 or more years are usually required to make projects financially viable. The high cost of debt in India adds to about 24%–32% of the total cost (additional 12%–19% of the total cost due to the debt finance and additional 13%–14% of the total cost due to the longer tenor).[10]

11. More specifically, the typical lending terms of Indian commercial banks are not well-matched to renewable energy projects, because of a maturity mismatch, given the short-term nature of bank deposits. Nonbank financial institutions can provide limited longer-term finance for renewable energy projects, but have traditionally done so based on existing relationships, and can be constrained by sector lending limits. This has restricted the entry of new and smaller independent renewable power producers to the market. Multilateral development banks and export credit agencies have provided substantial support to private sector project developers in the absence of adequate domestic finance availability, but these sources are limited in their ability to have a substantial impact, and their nonsovereign (private sector) operations may have also reached their respective exposure limits.

12. Assuming a typical 70:30 debt–equity ratio, the $39 billion total financing requirement for clean energy development under the Twelfth Five-Year Plan requires an equity contribution of about $12 billion, with most coming from the private sector. Equity funding will thus be a key constraint, particularly given equity investors' reduced market appetite for risk. Regulatory changes that will make projects commercially attractive are needed to draw increased equity capital into infrastructure investments; other changes (e.g., amendments in pension fund regulations to allow investment in equity markets) will also be beneficial. In terms of debt market instruments, bonds are a source of low-cost, long-tenor funds and suitable for infrastructure. However, Indian corporate bond markets are underdeveloped and illiquid. Restrictions on investments by institutional investors limit the range of bond financing options.[11]

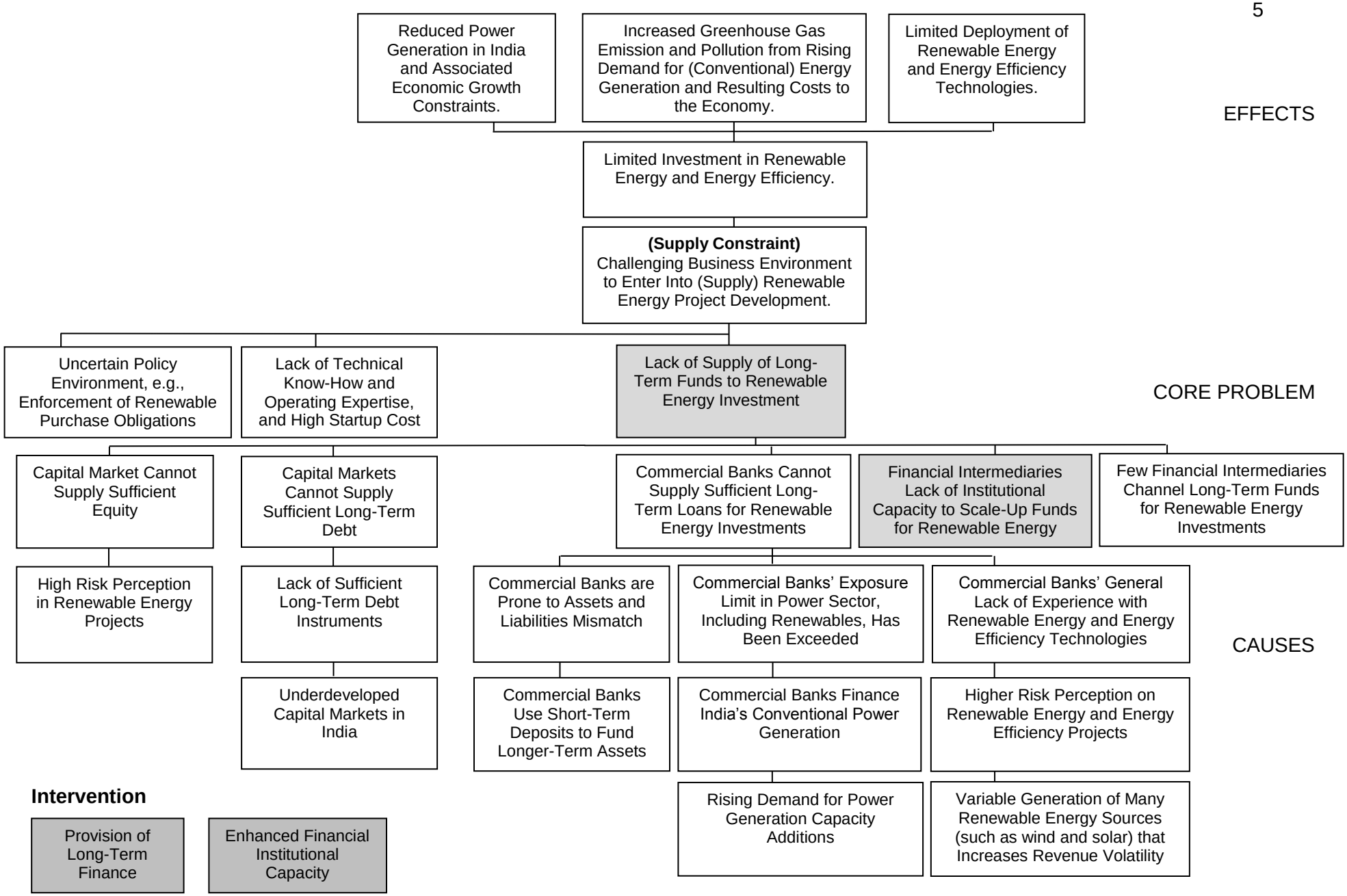
F. Indian Renewable Energy Development Agency

13. IREDA is the only wholly government-owned, nonbank financial institution with an exclusive mission of supporting India's renewable energy development. IREDA was established in 1987 to provide financial assistance for renewable energy and energy efficiency projects. IREDA is administratively controlled by MNRE and administers support schemes for it in addition to providing loans for project development. IREDA's deep knowledge of the sector and exclusive focus on renewable and energy efficiency projects has given it a higher risk appetite than other Indian banking institutions. IREDA can offer slightly lower interest rates and/or longer tenors than are found in the domestic banking and capital markets, thereby facilitating renewable project development and catalyzing private sector finance.

14. IREDA's loan activity in FY2011 supported over 1.4 GW of renewable capacity additions through seven different technologies. The largest share of IREDA's portfolio in terms of sanctioned loans is wind, followed by hydropower, co-generation, and solar photovoltaics. All technologies promoted by the government are represented in the portfolio. For the remainder of the Twelfth Five-Year Plan period, IREDA plans to continue to expand its operations to contribute an estimated 3.2 GW of additional renewable energy capacity by 2017, and approximately 8.4 GW during 2018–2024.

[10] G. Shrimali. 2013. *Financing of Renewable Energy in India: Implications for Policy*. http://www.internationalenergyworkshop.org/docs/IEW%202013_6E4Shrimali.pdf

[11] Insurance Regulatory and Development Authority regulations mandate a minimum AA investment criteria for insurance funds.


Reduced Power Generation in India and Associated Economic Growth Constraints.
Increased Greenhouse Gas Emission and Pollution from Rising Demand for (Conventional) Energy Generation and Resulting Costs to the Economy.
Limited Deployment of Renewable Energy and Energy Efficiency Technologies.
EFFECTS
Limited Investment in Renewable Energy and Energy Efficiency.
(Supply Constraint) Challenging Business Environment to Enter Into (Supply) Renewable Energy Project Development.
Uncertain Policy Environment, e.g., Enforcement of Renewable Purchase Obligations
Lack of Technical Know-How and Operating Expertise, and High Startup Cost
Lack of Supply of Long-Term Funds to Renewable Energy Investment
CORE PROBLEM
Capital Market Cannot Supply Sufficient Equity
Capital Markets Cannot Supply Sufficient Long-Term Debt
Commercial Banks Cannot Supply Sufficient Long-Term Loans for Renewable Energy Investments
Financial Intermediaries Lack of Institutional Capacity to Scale-Up Funds for Renewable Energy
Few Financial Intermediaries Channel Long-Term Funds for Renewable Energy Investments
High Risk Perception in Renewable Energy Projects
Lack of Sufficient Long-Term Debt Instruments
Commercial Banks are Prone to Assets and Liabilities Mismatch
Commercial Banks' Exposure Limit in Power Sector, Including Renewables, Has Been Exceeded
Commercial Banks' General Lack of Experience with Renewable Energy and Energy Efficiency Technologies
CAUSES
Underdeveloped Capital Markets in India
Commercial Banks Use Short-Term Deposits to Fund Longer-Term Assets
Commercial Banks Finance India's Conventional Power Generation
Higher Risk Perception on Renewable Energy and Energy Efficiency Projects
Rising Demand for Power Generation Capacity Additions
Variable Generation of Many Renewable Energy Sources (such as wind and solar) that Increases Revenue Volatility
Intervention
Provision of Long-Term Finance
Enhanced Financial Institutional Capacity

Sector Results Framework (Energy, 2013–2017)

Country Sector Outcomes		Country Sector Outputs		ADB Sector Operations	
Outcomes with ADB Contribution	**Indicators with Targets and Baselines**	**Outputs with ADB Contribution**	**Indicators with Incremental Targets**	**Planned and Ongoing ADB Interventions**	**Main Outputs Expected from ADB Interventions**
Increased and efficient use of energy, including renewable energy	(i) Aggregate technical and commercial losses reduced to 20% in 2017 (2011 baseline: 26%). (ii) 100% of villages electrified in 2017 (2012 baseline: 93.8%). (iii) Share of renewable energy in total commercial energy used increased to 1.43% by 2017 (2012 baseline: 1%). (iv) 11,000 MW of savings achieved through demand-side management and energy efficiency during 2012–2017 (2012 baseline = 0 MW).	Energy system expanded, improved, and well managed	(i) Nonrenewable generation capacity (including hydropower) increased by 88,537 MW by 2017 compared with 2012 level. (ii) Hydropower generation capacity increased by 10,897 MW by 2017 compared with 2012 level. (iii) Grid-connected renewable power generation capacity increased by 30,000 MW by 2017 compared with 2012 level; (a) wind power generation capacity increased by 15,000 MW by 2017 compared with 2012 level; (b) solar power generation capacity increased by 10,000 MW by 2017 compared with 2012 level; (c) small hydropower generation capacity increased by 2,100 MW by 2017 compared with 2012 level; and (d) biomass and other generation capacity increased by 2,900 MW by 2017 compared with 2012 level; (iv) Additional 110,340 ckm of power transmission lines installed or upgraded by 2017 compared with 2012 level. (v) Additional 1.3 million ckm of power distribution lines installed or upgraded by 2017 compared with 2012 level.[a] (vi) Additional 46,825 MW of non-renewable generation capacity (private sector) installed by 2017 compared with 2012 level.	**(i) Planned key activity areas** (a) solar power (20% of funds); (b) hydropower (15% of funds); (c) other renewable (10% of funds); (d) electrical power transmission (40% of funds); and (e) electrical power distribution (15% of funds). **(ii) Pipeline projects** 13 projects amounting to $1,948 million for 2013–2015 (including four projects categorized as EGM). **(iii) Ongoing projects** 26 ongoing loans amounting to $3,682 million as of 31 December 2012 (including two projects categorized as EGM).	**(i) Planned key activity areas** About 1,500 MW of solar, hydropower, and wind power installed and/or upgraded. **(ii) Pipeline projects** 1,250 MW of solar, hydropower, and wind power installed and/or upgraded. **(iii) Ongoing projects** 885 MW of hydropower being installed; 7,760 ckm of transmission lines being installed and/or upgraded; 104,481 ckm of distribution lines being installed and/or upgraded.

ADB = Asian Development Bank, ckm = circuit kilometer, EGM = effective gender mainstream, GWh = giga-watt hours, KV = kilovolts, MW = megawatt.

[a] This includes 135,000 ckm of 33 KV lines, 560,000 ckm of 11 KV lines and 610,000 ckm of low voltage lines.

Sources: Government of India, Planning Commission. 2012. *Twelfth Five-Year Plan*. New Delhi; Government of India, Planning Commission. 2011. *An Approach to the Twelfth Five-Year Plan*. New Delhi; Government of India, Planning Commission. 2011. *Mid-Term Appraisal for Eleventh Five-Year Plan 2007–2012*. New Delhi; and Asian Development Bank estimates.